

**Heather L. Buss**

U.S. Geological Survey, Water Resources Discipline  
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**Education**

*The Pennsylvania State University*: Attended 1999-2006

- B.S. 5/2001 Geosciences, with High Distinction & Honors, Phi Beta Kappa, Academic Advisor: Professor Susan L. Brantley, GPA 3.87 (4.0 scale) Thesis: AFM investigations of pitting on silicate surfaces by a soil bacterium.
- Ph.D. 8/2006 Geosciences, with concentrations in Aqueous Geochemistry & Biogeochemistry, Academic Advisor: Professor Susan L. Brantley, GPA 3.87 (4.0 scale), Dissertation: Biogeochemical Weathering of Iron-Silicate Minerals.

**Professional Work Experience**

- 10/2008– present Research Chemist GS-13, US Geological Survey, Water Resources Discipline, Menlo Park, CA. Lead Scientist and Coordinator of the Luquillo (Puerto Rico) Water Energy and Biogeochemical Budgets (WEBB) Project of the National Research Program (NRP).
- 9/2008– 10/2008 Research Hydrologist GS-12, US Geological Survey, Water Resources Discipline, Menlo Park, CA. Lead Scientist and Site Coordinator for Puerto Rico WEBB Program.
- 1/2008 – 2/2008 Visiting Researcher, Institut de Physique du Globe de Paris, Host: Professor Jérôme Gaillardet.
- 10/2006 – 9/2008 National Research Council (NRC) Postdoctoral Research Fellow, US Geological Survey, Water Resources Discipline, Menlo Park, CA. Lead Scientist and Site Coordinator for the Luquillo WEBB Project, Mentor: Dr. Arthur F. White.
- 5/2001 – 9/2006 Graduate Research Fellow, Department of Geosciences, Penn State University (3 years NSF Fellowship, 2 years Penn State Fellowships).
- 5/1999 – 5/2001 Undergraduate Research Assistant, Department of Geosciences, Penn State University.

**Selected Honors and Awards***Research Fellowships*

- 2006 The National Academy of Sciences (NRC) Postdoctoral Research Fellowship – 2 years
- 2006 Chelius Graduate Fellowship for Excellence in Earth Sciences, Penn State University – supplementary support for 1 year
- 2005 Biogeochemical Research Initiative for Education, Graduate Research Fellowship, Penn State University – 1 year
- 2002 The National Science Foundation (NSF) Graduate Research Fellowship – 3years
- 2001 Penn State University Graduate Research Fellowship – 1 year
- 2001 Biogeochemical Research Initiative for Education, Graduate Research Fellowship, Penn State University – 1 year

- 1999 Biogeochemical Research Initiative for Education, Undergrad. Research Fellowship, Penn State University – one summer

### Scholarships and Academic Awards

- 2003 Ohmoto Scholarship for Excellence in Astrobiology, Penn State University  
 2002 Ohmoto Scholarship for Excellence in Astrobiology, Penn State University  
 2000 Tait Scholarship for Excellence in Biogeochemistry, Penn State University  
 2000 Holmes Teas Scholarship for Excellence in Geosciences, Penn State University  
 2000 Ryan Scholarship for Excellence in Geosciences, Penn State University  
 1999 Ryan Scholarship for Excellence in Geosciences, Penn State University  
 2000 A.P. Honess Award for Excellence in Geosciences, Penn State University  
 2000 Drake Scholarship for Excellence in Geosciences, Penn State University  
 1999 Drake Scholarship for Excellence in Geosciences, Penn State University

### Presentation Awards

- 2005 Outstanding Student Presentation, American Chemical Society National Meeting, San Diego  
 2004 1st Place, Poster presentation, 7th Environmental Chemistry Symposium, Penn State University  
 2001 1st Place and Grand Prize, Oral presentation, 4th Environmental Chemistry Symposium, Penn State University  
 2000 1st Place undergraduate, Oral presentation, Allegheny Branch of the American Society for Microbiology, State College, PA, USA

## RESEARCH

### Peer-Reviewed Publications

- Glynn P.D., Larsen M.C., Greene E.A., **Buss H.L.**, Clow D.W., Hunt R.J., Mast M.A., Murphy S.F., Peters N.E., Sebestyen S.D., Shanley J.B., and Walker J.F. (*In Press*) Selected achievements, science directions, and new opportunities for the WEBB small watershed research program. *In* Webb, R.M.T., and Semmens, D.J., eds., *Proceedings of the Third Interagency Conference on Research in the Watersheds, 8-11 September 2008, Estes Park, CO.* 1-14.
- Buss H.L.**, Mathur R., White A.F., and Brantley S.L. (2009) Iron and phosphorus cycling in deep saprolite, Luquillo Mountains, Puerto Rico. *Chem. Geol.* doi:10.1016/j.chemgeo.2009.08.001.
- Buss H.L.**, Sak P.B., Webb S.M., and Brantley S.L. (2008) Weathering of the Rio Blanco quartz diorite, Luquillo Mountains, Puerto Rico: Coupling oxidation, dissolution, and fracturing. *Geochim. Cosmochim. Acta*, **72**, 4488-4507.
- Buss H.L.**, Lüttge A., and Brantley S.L. (2007) Etch pit and leached layer formation on iron-silicate surfaces during siderophore-promoted dissolution. *Chemical Geology*, **240**, 326-342.
- Bandstra J.Z., **Buss H.L.**, Campen R.K., Liermann L.J., Moore J., Hausrath E.M., Navarre-Sitchler A.K., Jang J.-H., and Brantley S.L. (2007) Appendix: Compilation of Mineral Dissolution Rates. *In* 'Kinetics of Water Rock Interactions' Eds. S.L. Brantley, J.D. Kubicki, and A.F. White. pp. 731-733.
- Fletcher R.C., **Buss H.L.**, and Brantley S.L. (2006) A spheroidal weathering model coupling porewater chemistry to soil thicknesses during steady state erosion. *EPSL*, **244**, 444-457.
- Buss H.L.**, Bruns M.A., Schultz M.J., Moore J., Mathur C.F., and Brantley S.L. (2005) The coupling of biological iron cycling and mineral weathering during saprolite formation, Luquillo Mountains, Puerto Rico. *Geobiology*, **3**, 247-260.

- Mathur R., Ruiz J., Tittley S., Liermann L., **Buss H.** and Brantley S. (2005) Cu isotopic fractionation in the supergene environment with and without bacteria. *Geochim. Cosmochim. Acta*, **69**, 5233-5246.
- Buss H.L.**, Sak P.B., White A.F., and Brantley S.L. (2004) Mineral dissolution at the granite-saprolite interface. In, Wanty R.B. and Seal R.R. II, eds., *Proc. of the 11th Intl. Symp. on Water-Rock Interaction*, Taylor and Francis, Lisse, the Netherlands, p. 819-823.
- Buss H.L.**, Brantley S.L., and Liermann L.J. (2003) Non-destructive methods for removal of bacteria from silicate surfaces. *Geomicrobiology J.* **20**, 25-42.

#### Submitted or In Final Preparation

- Buss H.L.**, White A.F., Vivit D.V., Blum A.E., Schulz M.S., Fitzpatrick J. and Bullen T.D. Lithological influences on contemporary weathering fluxes and rates in the Luquillo Mountains of Puerto Rico. *In final prep. for Geochimica et Cosmochimica Acta*.
- Buss H.L.** and White A.F. Weathering Processes in the Rio Icacos Watershed. In Stallard R.F. and Murphy S.F., eds., *Water Quality of the Luquillo Mountains, Puerto Rico, 1990-2005*. USGS Scientific Investigations Report. *In Review*.
- Sak P.B., Miller C.E., **Buss H.L.**, Daniel C., and Brantley S.L. Variations in elemental weathering rates as a function of clast geometry around a single basaltic andesite clast. *Submitted to Chemical Geology*.
- Minyard M.L., Bruns M.A., Liermann L.J., **Buss H.L.**, and Brantley S.L. Bacterial community composition and mineral associations at the saprolite interface with quartz diorite bedrock, Luquillo Experimental Forest, Puerto Rico. *In final prep. for Geobiology Journal*.

#### **Other Publications (Not Peer-reviewed)**

##### Internal USGS Documents

- Clow D, Walker D, Shanley J, Peters J, **Buss H**, Murphy S, and Mast A (2009) *Water, Energy, and Biogeochemical Budgets: Summary of Planned Research Activities and Products, 2010-2014*.

#### **Grants Awarded**

- 2010-2015 NSF, EAR (Earth Sciences) Critical Zone Observatories, *Luquillo Critical Zone Observatory*. My roles: Founding PI, Member of the Executive Committee, Coordinator of the USGS component of the project. \$5,000,000. <http://www.sas.upenn.edu/lczo/staff.html>.
- 2008-2010 NSF, EAR-Geobiology and Low Temperature Geochemistry, *Volcanicalstics vs. Granodiorites, Luquillo Mountains, Northeast Puerto Rico*. My role: co-PI with F. Scatena \$19,000. This is a sub-project of a larger project: *Using a Critical Zone Exploration Network to Quantify Controls on Earth's Regolith*, PI: S.L. Brantley.
- 2006-2008 The National Academy of Sciences (NRC) Research Associateship Program, *Coupling Critical Zone Biogeochemical Nutrient Cycling in Tropical Uplands: USGS WEBB Sites, Puerto Rico*. My role: PI. \$201,000.
- 2006 Critical Zone Exploration Network (CZEN) International Scholars Program (NSF funded), *A Critical Zone Site Comparison: Chemical Weathering and Nutrient Cycling in Tropical Uplands, Guadeloupe and Puerto Rico*. My role: PI. \$9,000.

- 2004 The Penn State Center for Environmental Chemistry and Geochemistry student research grant, *Spheroidal Weathering at the Bedrock-Saprolite Interface*. My role: PI. \$5,000.
- 2004 The Penn State Biogeochemical Research Initiative for Education (BRIE, NSF funded) student research grant, *Spheroidal Weathering and Iron Cycling in a Tropical Watershed, Luquillo Mountains, Puerto Rico*. My role: PI. \$4,000.
- 2003 The Penn State Biogeochemical Research Initiative for Education (BRIE, NSF funded) student research grant, *Microbial Influences on Mineral Weathering in a Tropical Watershed, Luquillo Mountains, Puerto Rico*. My role: PI. \$4,000.
- 2003 The Penn State Biogeochemical Research Initiative for Education (BRIE, NSF funded) student teaching grant, *Microbial Biomass as a Function of Depth in a Tropical Watershed, Luquillo Mountains, Puerto Rico*. This grant allowed me to mentor 3 microbiology students from an undergraduate-only institution (York College of PA) on a geomicrobiology research project. My role: PI. \$1,800.

### Other Grants (To which I made a major contribution)

- 2005-2008 DOE, Office of Basic Energy Science, *Rate and Mechanism of Transformation of Bedrock into Saprolite during Spheroidal Weathering*, PIs: S.L. Brantley, R.F. Fletcher, M.A. Bruns. My role: I contributed significantly to planning and writing this proposal. \$300,000.

### Invited Talks

- Oct 7, 2009 The University of Lausanne, Faculté des géosciences et de l'environnement, Lausanne, Switzerland.
- Feb. 5, 2008 École et Observatoire des Sciences de la Terre, Strasbourg, France.
- Oct. 15, 2007 The University of Bristol, UK, EU SoilCritZone Workshop.
- Feb. 12, 2007 Lehigh University, Department of Earth and Environmental Sciences.
- Feb. 13, 2007 Lehigh University, Department of Earth and Environmental Sciences.
- Dec. 7, 2006 The University of California at Berkeley, Department of Environmental Science.
- Nov. 3, 2006 The University of Pennsylvania, Department of Earth and Environmental Science.

### Presentations at Conferences

- 2009 Goldschmidt (Oral), Davos, Switzerland  
AGU Fall Meeting (planned) San Francisco, CA, USA
- 2008 Goldschmidt (Oral), Vancouver, Canada  
AGU Fall Meeting (Poster) San Francisco, CA, USA
- 2007 Goldschmidt (Oral) Cologne, Germany  
AGU Joint Assembly (Poster) Acapulco, Mexico  
AGU Fall Meeting (Oral) San Francisco, CA, USA
- 2006 AGU Fall Meeting (Oral) San Francisco, CA, USA
- 2005 Goldschmidt (Oral) Moscow, ID, USA  
Frontiers in Exploration of the Critical Zone (Poster) Newark, DE, USA  
American Chemical Society (Oral) San Diego, CA, USA

- 2004 Water-Rock Interaction (Oral) Saratoga Springs, NY, USA
- 2003 NASA Astrobiology Institute (Poster) Tempe, AZ, USA
- 2002 Gordon Conference: Environmental Bioinorganic Chemistry (Poster) Andover, NH, USA  
 Goldschmidt (Poster) Davos, Switzerland  
 AGU Fall Meeting (Poster) San Francisco, CA, USA  
 Allegheny Branch of the American Society of Microbiology (Oral) Clarion, PA, USA
- 2001 Goldschmidt (Oral) Hot Springs, VA, USA  
 Allegheny Branch of the American Society of Microbiology (Oral) State College, PA, USA

### Other Presentations

- 2005-2009 Co-author on 9 oral and poster presentations at national and international meetings.
- 1999-2006 Numerous student symposia, Penn State University

## TEACHING ACTIVITY

### Subjects Taught

- 2005 Guest Instructor: Penn State University GEOSC 201 Earth Materials, a core curriculum course in petrology and mineralogy for undergraduate geosciences majors. I developed and implemented lectures, laboratory activities, and assignments on layered mafic intrusions.
- 2002 Teaching Assistant: Penn State University GEOSC 413 Techniques in Environmental Geochemistry, an upper level undergraduate and graduate student course. I developed several laboratory projects and assisted students with field and laboratory work, data interpretation, and writing.
- 1992-1993 Teaching Assistant: Sam Houston State University (Huntsville, TX, USA) KIN 417 and KIN 210: I taught Water Safety Instructor Training and 2 semesters of adult swimming lessons.
- 1990-1994 The American Red Cross: 500+ hours teaching the following courses: Lifeguard Training, Community First Aid and Safety, Community CPR, CPR for the Professional Rescuer, Responding to Emergencies, and Swimming Lessons (all levels).

### Supervision and Training

- 2003-2009 Led 15 field trips to Puerto Rico for myself and collaborators, students, and visitors as described in the field work section, below. In most of these campaigns, training of undergraduates and postgraduates was a central component.
- 2003-2005 Supervised Undergraduate Research Projects: I designed and supervised research projects for 3 microbiology students from York College of Pennsylvania in order to provide them with environmentally-relevant field and laboratory experience. Two senior theses were produced, and one of those students (Matt Schultz) came to Penn State to continue his work with me on a summer fellowship. Some of this work is included in a published paper (Buss et al., 2005).
- 2005 Co-supervised a sophomore from the Univ. of Puerto Rico on a summer project in geomicrobiology at Penn State University.

## LEADERSHIP AND ACADEMIC SERVICE

### Administration

#### People Management and Supervision

- 2003-2006 Undergraduate project supervision as described above.
- 2006-present Supervise a USGS Technician: As WEBB coordinator for the Luquillo, PR field site I am responsible for a GS-5 Hydrologic Technician who is responsible for collecting and processing samples and assisting me during my field campaigns. I teach him (in both English and Spanish) how and why to perform specific tasks related to collection and processing of samples for geochemical analyses, and I evaluate his work.
- 2004-present Supervised/Trained Students in the field (in Puerto Rico): 4 Ph.D. candidates from Penn State (2006-2008), 1 M.S. student from Univ. Puerto Rico (2008), 1 undergraduate from the Univ. of Pennsylvania (2007), and 1 undergraduate from the Univ. of Puerto Rico (2004).

#### Budget Management

- 2006-present I manage the accounts for the USGS Luquillo WEBB Project in two cost centers (The USGS National Research Program in Menlo Park, CA and the USGS Caribbean District in San Juan, PR).
- 2003-2006 Managed budgets for 5 student research grants for which I was PI (please refer to the *Grants Awarded* section above).

#### Project Management

- 2006-present Director of the USGS Luquillo WEBB Project. Administrative (non-research) duties include overseeing ongoing WEBB research activities by other scientists at the field site, leading field campaigns, teaching field techniques to visiting students, supervising technicians, managing accounts, and facilitating research by collaborators at the site. I act as the USGS site-representative in interactions with the US Forest Service and the National Science Foundation.

### Field Work Leadership and Organization

- 2009 I am currently planning and organizing a project (subject to availability of funding) to drill 3 boreholes to 100' in crystalline rock in Puerto Rico. Responsibilities include obtaining funding and permits, soliciting bids from 3 drilling companies, contracting with the drillers and borehole geophysicists, coordinating about 15 people who will be involved, and overseeing all aspects of the project including sample collection (solid cores and water samples), geophysical logging, installation of packers, and maintenance.
- 2003-2009 Led 15 field trips to Puerto Rico for myself and collaborators, students, and visitors from the USGS and several universities (Boston Univ, Penn State, Univ. Penn, Univ. of Puerto Rico, Institut de Physique du Globe de Paris, and École et Observatoire des Sciences de la Terre de Strasbourg): coordinated logistics, led site tours, and taught specific techniques. Field work included installation of lysimeters for sampling soil pore water (0-18 m depth); tensiometers (to measure soil water tension); soil gas samplers; rain collectors and gages; and collection of rock, soil, water, gas, and vegetation samples for geochemical and microbiological analyses.

- 2007-2008 Led 2 field trips to Guadeloupe, French Antilles: Similar work as in Puerto Rico.
- 2000-2001 Undergraduate field work in Utah, Wyoming, Montana, Idaho, and Pennsylvania including a 7-week field camp: Mapping, stratigraphic interpretation, and sampling of waters, soils, and rocks for microbiological and geochemical analyses.

## Collaborators

### Current

A.F. White, T. Bullen, and A.E. Blum (USGS), D. Vance and P. Pogge von Strandmann (Univ. Bristol), S.L. Brantley (Penn State), F. Chabaux (École et Observatoire des Sciences de la Terre, Strasbourg, France), J. Galliardet (Institut de Physique du Globe de Paris, France), A. Dosseto (Wollongong Univ., Australia), C. Dessert (Observatoire volcanologique de Guadeloupe, French Antilles), E.T. Tipper (Cambridge, UK), F. Scatena (Univ. Penn), M.A. Bruns (Soil Microbiology, Penn State), D. Liptzin (Soil Ecology, Univ. Calif. Berkeley).

### Recent

S.M. Webb (Stanford Synchrotron Radiation Lab), R.C. Fletcher (Penn State), R. Mathur (Juniata College), A. Lüttge (Rice Univ.), P.B. Sak (Dickinson College), C. Mathur (Microbiology, York College, PA).

## Advisor to Workshops and Panels

- 2007-2008 **Invited Participant:** Served as an international advisor at the series of SoilCritZone Workshops, sponsored by the European Commission to develop the research strategy on soil conservation for the European Union.
- 5-9 Sept 2008, Chania, Crete, Greece
  - 6-9 April 2008, Sofia, Bulgaria
  - 14-16 Oct 2007, Bristol, UK
- 2008 **Invited Panelist:** Critical Zone Exploration Network (CZEN) Meeting, 16 July, Vancouver, BC, Canada.
- 2007 **Invited Participant:** Critical Zone Exploration Network (CZEN) Data and Information Systems Workshop. An NSF-sponsored workshop to identify what measurements should be made at all Critical Zone Observatories to allow cross-site comparison and what cyberinfrastructure should be developed to support the data. 17-18 Sept, Penn State University, USA.
- 2005 **Invited Participant:** Frontiers in Exploration of the Critical Zone, an NSF-sponsored workshop to define the research questions of the scientific community involved in investigation of the critical zone. 24-26 Oct., University of Delaware, USA.

## Symposia Organized

- 2010 **Buss H.L.** and Riebe C. *Lithologic and Erosional Influences on Critical Zone Processes*. Goldschmidt 2010, Knoxville TN, USA.
- 2009 Jin L. and **Buss H.L.**, *Waters in the Critical Zones: Major Elements, Trace Elements, and Isotopes as Biogeochemical Tracers*. AGU Fall Meeting 2009, San Francisco, CA, USA.
- 2008 **Buss H.L.** and Ragnarsdottir K.V. *Multiple approaches for assessing processes in the critical zone: Focus on watersheds around the world*. Goldschmidt 2008, Vancouver, Canada (25 papers presented).

- 2005 **Buss H.L.**, Burgos W.B., Lüttge A. *From Atoms to Mountains: Scaling up in Geochemical Kinetics*. American Chemical Society Meeting, San Diego, CA, USA (18 papers presented).
- 2004 Chorover J. and **Buss H.L.** *Iron Biogeochemistry*. 11<sup>th</sup> International Symposium on Water-Rock Interaction, Saratoga Springs, NY, USA (8 papers presented).
- 2004 **Buss H.L.** and Ruebush S.S. *7<sup>th</sup> Environmental Chemistry Student Symposium*. Center for Environmental Chemistry and Geochemistry (CECG), Penn State University (70 papers presented).

### Editorial and Reviewing Work

#### Proposal Reviewer for the following programs

NSF (GEO/EAR) Geobiology and Low-Temperature Geochemistry, NSF (GEO/EAR) Geomorphology and Land Use Dynamics, NSF (GEO/EAR) Tectonics, NSF (EAR) Earth Sciences Education and Human Resources.

#### Manuscript Reviewer for the following journals

*Geochimica et Cosmochimica Acta, Geoderma, American Journal of Science, Water Resources Research, Soil Chemistry, Biogeochemistry, G-cubed, Quaternary Research, Earth Surface Processes and Landforms, The ISME Journal: Multidisciplinary Journal of Microbial Ecology.*

### Professional Memberships

The Geochemical Society, Mineralogical Society of America, American Geophysical Union, Soil Science Society of America, NASA Astrobiology Institute.

### OTHER ACTIVITIES

- Semi-fluent in Spanish (7 years of classes, summer study in Spain 1990, practice in Puerto Rico)
- Academic Clubs and Societies
  - Organizing Committee, Environmental Chemistry Student Symposium, PSU 2002-2004
  - Organizing Committee, Founding Member, Penn State Research Unplugged 2003-2005
  - Honors Societies: Phi Beta Kappa, Phi Kappa Phi, Phi Theta Kappa
  - The Penn State Geological Sciences Club 1999-2001
- Photography Student, Brooks Institute of Photography, Santa Barbara, CA 1994, and Sam Houston State University, Huntsville, TX 1992-1993